Gunter, Jason

From: James, Kevin <kjames@doerun.com>
Sent: Monday, April 13, 2015 10:25 AM
To: Gunter, Jason
Cc: Yingling, Mark; Neaville, Chris; Montgomery, Michael; 'brandon.wiles@dnr.mo.gov'; 'Ty Morris (TMorris@barr.com)'
Subject: Leadwood Progress Report - March
Attachments: removed.txt; Leadwood_ProgressReport_03-15.pdf; 2015-03-23 LW NPDES Pace Lab Report.pdf; 2015-03-12 LW NPDES Pace Lab Report.pdf; Remediation Air Report - February 2015.pdf

Categories: Red Category

Jason -

Attached is the March Progress Report for the Leadwood Site.

Best regards,

Kevin James

Kevin James
Construction Engineering
W: 573.626.2096
C: 573.247.6766

THE DOE RUN COMPANY

Remediation Group

Kevin James
Construction Engineering Manager
kjames@doerun.com

April 13, 2015

Mr. Jason Gunter
Remedial Project Manager
U.S. Environmental Protection Agency
Region 7 - Superfund Branch
11201 Renner Blvd.
Lenexa, KS 66219

Re: The Doe Run Company - Leadwood Mine Tailings Site Monthly Progress Report

Dear Mr. Gunter:

As required by Article VI, Section 50 of the Unilateral Administrative Order (Docket No. CERCLA-07-2006-0272) for the referenced project and on behalf of The Doe Run Company, the progress report for the period March 1, 2015 through March 31, 2015 is enclosed. If you have any questions or comments, please call me at 573-626-2096.

Sincerely,

Kevin James
Construction Engineering Manager

Enclosures
c: Mark Yingling – TDRC (electronic only)
Chris Neaville – TDRC (electronic only)
Michael Montgomery – TDRC (electronic only)
Brandon Wiles – MDNR
Ty Morris – Barr Engineering

Leadwood Mine Tailings Site
Leadwood, Missouri
Removal Action - Monthly Progress Report
Period: March 1, 2015 – March 31, 2015

1. **Actions Performed or Completed This Period:**
   a. Work continued on the development of the Post Removal Site Control Plan for the site.
2. **Data and Results Received This Period:**
   a. During this period, water samples were collected from downstream of Leadwood Dam and the East Seep and Erosion Area, as well as from upstream and downstream of the confluence of Eaton Creek with Big River. The analytical results for this event are included with this progress report.
   b. During this period, the ambient air monitoring samples for February were processed and the Ambient Air Monitoring Report for February 2015 was completed and is attached. A copy of the Ambient Air Monitoring Report for February is attached.
3. **Scheduled Activities not Completed This Period:**
   a. None.
4. **Planned Activities for Next Period:**
   a. Continue developing the Post Removal Site Control Plan for the site.
   b. Complete monthly water sampling activities as described in the Removal Action Work Plan.
   c. Complete air monitoring activities as described in the Removal Action Work Plan.
5. **Changes in Personnel:**
   a. None.
6. **Issues or Problems Arising This Period:**
   a. None.
7. **Resolution of Issues or Problems Arising This Period:**
   a. None.

Pace Analytical Services, Inc.
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

March 31, 2015

Amy Sanders
The Doe Run Company
P. O. Box 500
Viburnum, MO 65566

RE: Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

Dear Amy Sanders:
Enclosed are the analytical results for sample(s) received by the laboratory on March 24, 2015. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church
jamie.church@pacelabs.com
Project Manager

Enclosures

Pace Analytical Services, Inc.
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

CERTIFICATIONS

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

Kansas Certification IDs
9608 Loiret Boulevard, Lenexa, KS 66219
WY STR Certification #: 2456.01
Arkansas Certification #: 13-012-0
Illinois Certification #: 003097
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212008A
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407
Utah Certification #: KS00021

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

SAMPLE SUMMARY

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60190337001	29755 / LEADWOOD DOWNSTREAM	Water	03/23/15 10:53	03/24/15 06:20
60190337002	29756 / LEADWOOD UPSTREAM	Water	03/23/15 11:00	03/24/15 06:20

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SAMPLE ANALYTE COUNT

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60190337001	**29755 / LEADWOOD DOWNSTREAM**	EPA 200.7	SMW	6	PASI-K
		EPA 200.7	SMW	3	PASI-K
		SM 2540D	JMC1	1	PASI-K
		EPA 300.0	OL	1	PASI-K
60190337002	**29756 / LEADWOOD UPSTREAM**	EPA 200.7	JGP, SMW	6	PASI-K
		EPA 200.7	SMW	3	PASI-K
		SM 2540D	JMC1	1	PASI-K
		EPA 300.0	OL	1	PASI-K

Pace Analytical Services, Inc.
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Lenexa, KS 66219
(913)599-5665

ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

Sample: 29755 / LEADWOOD DOWNSTREAM **Lab ID: 60190337001** Collected: 03/23/15 10:53 Received: 03/24/15 06:20 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium	ND	ug/L	5.0	0.56	1	03/27/15 10:15	03/27/15 17:44	7440-43-9	
Calcium	**36600**	ug/L	100	5.2	1	03/27/15 10:15	03/27/15 17:44	7440-70-2	
Lead	ND	ug/L	5.0	1.9	1	03/27/15 10:15	03/27/15 17:44	7439-92-1	
Magnesium	**20900**	ug/L	50.0	13.3	1	03/27/15 10:15	03/27/15 17:44	7439-95-4	
Total Hardness by 2340B	**177000**	ug/L	500		1	03/27/15 10:15	03/27/15 17:44		
Zinc	**26.9J**	ug/L	50.0	2.6	1	03/27/15 10:15	03/27/15 17:44	7440-66-6	
200.7 Metals, Dissolved (LF)	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium, Dissolved	ND	ug/L	5.0	0.56	1	03/26/15 10:00	03/26/15 18:47	7440-43-9	
Lead, Dissolved	ND	ug/L	5.0	1.9	1	03/26/15 10:00	03/26/15 18:47	7439-92-1	
Zinc, Dissolved	**18.0J**	ug/L	50.0	2.6	1	03/26/15 10:00	03/26/15 18:47	7440-66-6	
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	**12.0**	mg/L	5.0	5.0	1		03/30/15 14:28		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Sulfate	**19.8**	mg/L	2.0	0.47	2		03/29/15 13:15	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
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Lenexa, KS 66219
(913)599-5665

ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

Sample: 29756 / LEADWOOD UPSTREAM **Lab ID: 60190337002** Collected: 03/23/15 11:00 Received: 03/24/15 06:20 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium	ND	ug/L	5.0	0.56	1	03/27/15 10:15	03/27/15 17:51	7440-43-9	
Calcium	**31500**	ug/L	100	5.2	1	03/27/15 10:15	03/30/15 15:15	7440-70-2	
Lead	**2.5J**	ug/L	5.0	1.9	1	03/27/15 10:15	03/27/15 17:51	7439-92-1	
Magnesium	**20900**	ug/L	50.0	13.3	1	03/27/15 10:15	03/27/15 17:51	7439-95-4	
Total Hardness by 2340B	**165000**	ug/L	500		1	03/27/15 10:15	03/27/15 17:51		
Zinc	ND	ug/L	50.0	2.6	1	03/27/15 10:15	03/27/15 17:51	7440-66-6	
200.7 Metals, Dissolved (LF)	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium, Dissolved	ND	ug/L	5.0	0.56	1	03/26/15 10:00	03/26/15 18:50	7440-43-9	
Lead, Dissolved	ND	ug/L	5.0	1.9	1	03/26/15 10:00	03/26/15 18:50	7439-92-1	
Zinc, Dissolved	**2.7J**	ug/L	50.0	2.6	1	03/26/15 10:00	03/26/15 18:50	7440-66-6	
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	**24.0**	mg/L	5.0	5.0	1		03/30/15 14:28		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Sulfate	**14.5**	mg/L	2.0	0.47	2		03/29/15 13:29	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
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(913)599-5665

QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

QC Batch: MPRP/31208
QC Batch Method: EPA 200.7
Analysis Method: EPA 200.7
Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60190337001, 60190337002

METHOD BLANK: 1540091 Matrix: Water
Associated Lab Samples: 60190337001, 60190337002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Cadmium	ug/L	ND	5.0	03/27/15 17:24	
Calcium	ug/L	8.8J	100	03/27/15 17:24	
Lead	ug/L	ND	5.0	03/27/15 17:24	
Magnesium	ug/L	ND	50.0	03/27/15 17:24	
Total Hardness by 2340B	ug/L	ND	500	03/27/15 17:24	
Zinc	ug/L	ND	50.0	03/27/15 17:24	

LABORATORY CONTROL SAMPLE: 1540092

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Cadmium	ug/L	1000	1040	104	85-115	
Calcium	ug/L	10000	10700	107	85-115	
Lead	ug/L	1000	1050	105	85-115	
Magnesium	ug/L	10000	10600	106	85-115	
Total Hardness by 2340B	ug/L		70400			
Zinc	ug/L	1000	1040	104	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1540093 1540094

Parameter	Units	60190169001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Cadmium	ug/L	ND	1000	1000	1030	1040	103	104	70-130	1	20	
Calcium	ug/L	69900	10000	10000	81500	79400	116	94	70-130	3	20	
Lead	ug/L	ND	1000	1000	1000	1010	100	101	70-130	1	20	
Magnesium	ug/L	5010	10000	10000	15300	15200	103	102	70-130	1	20	
Total Hardness by 2340B	ug/L	195000			267000	261000				2		
Zinc	ug/L	ND	1000	1000	1050	1060	100	101	70-130	1	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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(913)599-5665

QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

QC Batch: MPRP/31184
QC Batch Method: EPA 200.7
Analysis Method: EPA 200.7
Analysis Description: 200.7 Metals, Dissolved
Associated Lab Samples: 60190337001, 60190337002

METHOD BLANK: 1539308 Matrix: Water
Associated Lab Samples: 60190337001, 60190337002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Cadmium, Dissolved	ug/L	ND	5.0	03/26/15 18:34	
Lead, Dissolved	ug/L	ND	5.0	03/26/15 18:34	
Zinc, Dissolved	ug/L	ND	50.0	03/26/15 18:34	

LABORATORY CONTROL SAMPLE: 1539309

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Cadmium, Dissolved	ug/L	1000	1010	101	85-115	
Lead, Dissolved	ug/L	1000	1070	107	85-115	
Zinc, Dissolved	ug/L	1000	1020	102	85-115	

MATRIX SPIKE SAMPLE: 1539310

Parameter	Units	60190336001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Cadmium, Dissolved	ug/L	ND	1000	1030	103	70-130	
Lead, Dissolved	ug/L	ND	1000	1040	104	70-130	
Zinc, Dissolved	ug/L	75.6	1000	1060	98	70-130	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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(913)599-5665

QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

QC Batch: WET/53796 Analysis Method: SM 2540D
QC Batch Method: SM 2540D Analysis Description: 2540D Total Suspended Solids
Associated Lab Samples: 60190337001, 60190337002

METHOD BLANK: 1541151 Matrix: Water
Associated Lab Samples: 60190337001, 60190337002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Suspended Solids	mg/L	ND	5.0	03/30/15 14:24	

SAMPLE DUPLICATE: 1541152

Parameter	Units	60190306002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Suspended Solids	mg/L	29.0	31.0	7	10	

SAMPLE DUPLICATE: 1541153

Parameter	Units	60190332002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Suspended Solids	mg/L	20.0	17.0	16	10	D6

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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(913)599-5665

QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

QC Batch: WETA/33396 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60190337001, 60190337002

METHOD BLANK: 1541027 Matrix: Water
Associated Lab Samples: 60190337001, 60190337002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	1.0	03/29/15 09:56	

LABORATORY CONTROL SAMPLE: 1541028

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	5	4.9	99	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1541029 1541030

Parameter	Units	60190042002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	1160	500	500	1670	1660	102	99	80-120	1	15	

MATRIX SPIKE SAMPLE: 1541031

Parameter	Units	60190042003 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	1070	500	1590	104	80-120	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
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(913)599-5665

QUALIFIERS

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City

ANALYTE QUALIFIERS

D6 The relative percent difference (RPD) between the sample and sample duplicate exceeded laboratory control limits.

Pace Analytical Services, Inc.
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: NPDES (LEADWOOD)
Pace Project No.: 60190337

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60190337001	29755 / LEADWOOD DOWNSTREAM	EPA 200.7	MPRP/31208	EPA 200.7	ICP/23233
60190337002	29756 / LEADWOOD UPSTREAM	EPA 200.7	MPRP/31208	EPA 200.7	ICP/23233
60190337001	29755 / LEADWOOD DOWNSTREAM	EPA 200.7	MPRP/31184	EPA 200.7	ICP/23218
60190337002	29756 / LEADWOOD UPSTREAM	EPA 200.7	MPRP/31184	EPA 200.7	ICP/23218
60190337001	29755 / LEADWOOD DOWNSTREAM	SM 2540D	WET/53796		
60190337002	29756 / LEADWOOD UPSTREAM	SM 2540D	WET/53796		
60190337001	29755 / LEADWOOD DOWNSTREAM	EPA 300.0	WETA/33396		
60190337002	29756 / LEADWOOD UPSTREAM	EPA 300.0	WETA/33396		

Pace Analytical
www.pacelabs.com

Sample Condition Upon Receipt

WO#: 60190337

60190337

Client Name: Doe Run

Optional
Proj Due Date:
Proj Name:

Courier: FedEx ☐ UPS ☐ VIA ☑ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Other ☐ Client ☐

Tracking #: _____ Pace Shipping Label Used? Yes ☑ No ☐

Custody Seal on Cooler/Box Present: Yes ☑ No ☐ Seals intact: Yes ☑ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☑ Zplc

Thermometer Used: T-239 / T-194 **Type of Ice:** (Wet) Blue None ☐ Samples received on ice, cooling process has begun.
(circle one)

Cooler Temperature: 2.1

Date and initials of person examining contents: BB 3/24/15

Temperature should be above freezing to 6°C

Chain of Custody present:	☑Yes ☐No ☐N/A	1.
Chain of Custody filled out:	☑Yes ☐No ☐N/A	2.
Chain of Custody relinquished:	☑Yes ☐No ☐N/A	3.
Sampler name & signature on COC:	☑Yes ☐No ☐N/A	4.
Samples arrived within holding time:	☑Yes ☐No ☐N/A	5.
Short Hold Time analyses (<72hr):	☐Yes ☑No ☐N/A	6.
Rush Turn Around Time requested:	☐Yes ☑No ☐N/A	7.
Sufficient volume:	☑Yes ☐No ☐N/A	8.
Correct containers used:	☑Yes ☐No ☐N/A	
Pace containers used:	☑Yes ☐No ☐N/A	9.
Containers intact:	☑Yes ☐No ☐N/A	10.
Unpreserved 5035A soils frozen w/in 48hrs?	☐Yes ☐No ☑N/A	11.
Filtered volume received for dissolved tests?	☐Yes ☐No ☑N/A	12.
Sample labels match COC:	☑Yes ☐No ☐N/A	
Includes date/time/ID/analyses Y Matrix: water		13.
All containers needing preservation have been checked.	☑Yes ☐No ☐N/A	
All containers needing preservation are found to be in compliance with EPA recommendation.	☑Yes ☐No ☐N/A	14.
Exceptions: VOA, Coliform, O&G, WI-DRO (water)	☐Yes ☑No	Initial when completed / Lot # of added preservative
Trip Blank present:	☐Yes ☐No ☑N/A	
Pace Trip Blank lot # (if purchased): _____		15.
Headspace in VOA vials (>6mm):	☐Yes ☐No ☑N/A	16.
Project sampled in USDA Regulated Area:	☐Yes ☐No ☑N/A	17. List State:

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Jamie Church 3/24/15

Project Manager Review: _____ Date: _____

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

THE DOE RUN COMPANY

Section A — Required Client Information:

Company:	The Doe Run Company
Address:	PO Box 500
Email To:	asanders@doerun.com
Phone: (573) 689-4535	Fax: (573) 244-8179
Requested Due Date/TAT:	5 To 7 Days

Section B — Required Project Information:

Report To:	Amy Sanders
Copy To:	
Purchase Order No.:	
Project Name:	NPDES (Leadwood)
Project Number:	

Section C — Invoice Information:

Attention:	Amy Sanders
Company Name:	The Doe Run Company
Address:	PO Box 500, Viburnum, MO 65566
Pace Quote Reference:	
Pace Project Manager:	
Pace Profile #:	

REGULATORY AGENCY: ☐ NPDES ☐ GROUND WATER ☐ UST ☐ RCRA

Site Location STATE: MO

Page: 1 of 1

COC#: 1736

60190837

Requested Analysis Filtered (Y/N)

Section C — Required Sample Information

Valid Matrix Codes: MATRIX (WATER, WASTE WATER, SOIL/SOLID) — CODE (WT, WW, SL)

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

ITEM #	SAMPLE ID			MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE/TIME: COMPOSITE START DATE (mm/dd/yy)	COMPOSITE START TIME (Military)	COMPOSITE END / GRAB DATE (mm/dd/yy)	COMPOSITE END / GRAB TIME (Military)	SAMPLE TEMP AT COLLECTION	Total # OF CONTAINERS	Bottles / Preservatives: 250 mL Unpreserved	500 mL Unpreserved	1 L Unpreserved	250 mL Nitric	250 mL Amber Glass H_2SO_4	250 mL Plastic H_2SO_4	1000 mL Amber HCL	250 mL ZnAc/NaOH	500 mL Amber Glass H_2SO_4	*See Additional Comments Below — Analysis Test ↓	SEMO Lab Project No./ Lab I.D.
1	29755	BP1N	BP3N 2.°	WT	G			03/23/15	[illegible]		2	1			1							CD-D, PB-D, ZN-D, HARD, SO4, CD-T, PB-T, TSS-T, ZN-T	Leadwood Downstream (N)
2																						
3	29756	↓	↓	WT	G			03/23/15	11:[illegible]		2	1			1							CD-D, PB-D, ZN-D, HARD, SO4, CD-T, PB-T, TSS-T, ZN-T	Leadwood Upstream (N)
4																						
5																						
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ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME (Military)	ACCEPTED BY / AFFILIATION	DATE	TIME (Military)	SAMPLE CONDITIONS
	[signature]	3/23/15	1500	Kim B.	3/24	0620	L.1 / 2.0 / Y / Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Amber Nipper

SIGNATURE of SAMPLER: [signature]

DATE Signed (MM/DD/YY): 3/23/15

Temp in °C | pH in SU | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N)

Pace Analytical Services, Inc.
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

March 19, 2015

Amy Sanders
The Doe Run Company
P. O. Box 500
Viburnum, MO 65566

RE: Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

Dear Amy Sanders:
Enclosed are the analytical results for sample(s) received by the laboratory on March 13, 2015. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jamie Church
jamie.church@pacelabs.com
Project Manager

Enclosures

Pace Analytical Services, Inc.
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

CERTIFICATIONS

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

Kansas Certification IDs
9608 Loiret Boulevard, Lenexa, KS 66219
WY STR Certification #: 2456.01
Arkansas Certification #: 13-012-0
Illinois Certification #: 003097
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212008A
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407
Utah Certification #: KS00021

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
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Lenexa, KS 66219
(913)599-5665

SAMPLE SUMMARY

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60189645001	**29119 / LEADWOOD 001**	Water	03/12/15 10:19	03/13/15 08:35
60189645002	**29120 / LEADWOOD 002**	Water	03/12/15 10:36	03/13/15 08:35

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SAMPLE ANALYTE COUNT

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60189645001	**29119 / LEADWOOD 001**	EPA 200.7	JGP	3	PASI-K
		SM 2540D	JMC1	1	PASI-K
		SM 2540F	JMC1	1	PASI-K
		EPA 300.0	OL	1	PASI-K
60189645002	**29120 / LEADWOOD 002**	EPA 200.7	JGP	3	PASI-K
		SM 2540D	JMC1	1	PASI-K
		SM 2540F	JMC1	1	PASI-K
		EPA 300.0	OL	1	PASI-K

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ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

Sample: 29119 / LEADWOOD 001 **Lab ID: 60189645001** Collected: 03/12/15 10:19 Received: 03/13/15 08:35 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium	**0.68J**	ug/L	5.0	0.56	1	03/13/15 16:15	03/16/15 16:35	7440-43-9	
Lead	**3.3J**	ug/L	5.0	2.2	1	03/13/15 16:15	03/16/15 16:35	7439-92-1	
Zinc	**239**	ug/L	50.0	12.5	1	03/13/15 16:15	03/16/15 16:35	7440-66-6	
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	**9.0**	mg/L	5.0	5.0	1		03/18/15 09:42		
2540F Total Settleable Solids	Analytical Method: SM 2540F								
Total Settleable Solids	ND	mL/L/hr	0.20	0.20	1		03/13/15 12:30		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Sulfate	**70.3**	mg/L	5.0	1.2	5		03/15/15 13:11	14808-79-8	

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ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

Sample: 29120 / LEADWOOD 002 **Lab ID: 60189645002** Collected: 03/12/15 10:36 Received: 03/13/15 08:35 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium	**4.6J**	ug/L	5.0	0.56	1	03/13/15 16:15	03/16/15 16:38	7440-43-9	
Lead	**9.4**	ug/L	5.0	2.2	1	03/13/15 16:15	03/16/15 16:38	7439-92-1	
Zinc	**4260**	ug/L	50.0	12.5	1	03/13/15 16:15	03/16/15 16:38	7440-66-6	
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	**11.0**	mg/L	5.0	5.0	1		03/18/15 09:42		
2540F Total Settleable Solids	Analytical Method: SM 2540F								
Total Settleable Solids	ND	mL/L/hr	0.20	0.20	1		03/13/15 12:30		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Sulfate	**327**	mg/L	20.0	4.7	20		03/14/15 15:48	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
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QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

QC Batch: MPRP/31058
QC Batch Method: EPA 200.7
Analysis Method: EPA 200.7
Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60189645001, 60189645002

METHOD BLANK: 1533346 Matrix: Water
Associated Lab Samples: 60189645001, 60189645002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Cadmium	ug/L	ND	5.0	03/16/15 16:22	
Lead	ug/L	ND	5.0	03/16/15 16:22	
Zinc	ug/L	ND	50.0	03/16/15 16:22	

LABORATORY CONTROL SAMPLE: 1533347

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Cadmium	ug/L	1000	953	95	85-115	
Lead	ug/L	1000	933	93	85-115	
Zinc	ug/L	1000	993	99	85-115	

MATRIX SPIKE SAMPLE: 1533348

Parameter	Units	60189657001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Cadmium	ug/L	ND	1000	957	96	70-130	
Lead	ug/L	ND	1000	904	90	70-130	
Zinc	ug/L	ND	1000	956	92	70-130	

MATRIX SPIKE SAMPLE: 1533349

Parameter	Units	60189523001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Cadmium	ug/L	7.3	1000	956	95	70-130	
Lead	ug/L	37.4	1000	913	88	70-130	
Zinc	ug/L	ND	1000	909	91	70-130	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

QC Batch: WET/53566 Analysis Method: SM 2540D
QC Batch Method: SM 2540D Analysis Description: 2540D Total Suspended Solids
Associated Lab Samples: 60189645001, 60189645002

METHOD BLANK: 1534851 Matrix: Water
Associated Lab Samples: 60189645001, 60189645002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Suspended Solids	mg/L	ND	5.0	03/18/15 09:37	

SAMPLE DUPLICATE: 1534852

Parameter	Units	60189615001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Suspended Solids	mg/L	45.0	47.0	4	10	

SAMPLE DUPLICATE: 1534853

Parameter	Units	60189597003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Suspended Solids	mg/L	223	200	11	10	D6

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

QC Batch: WETA/33196 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60189645002

METHOD BLANK: 1533527 Matrix: Water
Associated Lab Samples: 60189645002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	1.0	03/14/15 08:56	

LABORATORY CONTROL SAMPLE: 1533528

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	5	4.9	99	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1533529 1533530

Parameter	Units	60189390002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	24.6	100	100	119	119	94	94	80-120	0	15	

MATRIX SPIKE SAMPLE: 1533531

Parameter	Units	60189555001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	1930	1000	2960	103	80-120	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

QC Batch: WETA/33200 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60189645001

METHOD BLANK: 1533811 Matrix: Water
Associated Lab Samples: 60189645001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	1.0	03/15/15 11:07	

LABORATORY CONTROL SAMPLE: 1533812

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	5	4.9	98	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1533813 1533814

Parameter	Units	60189645001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	70.3	25	25	95.4	95.1	101	99	80-120	0	15	

MATRIX SPIKE SAMPLE: 1533815

Parameter	Units	60189588002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	1360	500	1890	105	80-120	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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(913)599-5665

QUALIFIERS

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City

ANALYTE QUALIFIERS

D6 The relative percent difference (RPD) between the sample and sample duplicate exceeded laboratory control limits.

Pace Analytical Services, Inc.
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Lenexa, KS 66219
(913)599-5665

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: NPDES (LEADWOOD)
Pace Project No.: 60189645

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60189645001	**29119 / LEADWOOD 001**	EPA 200.7	MPRP/31058	EPA 200.7	ICP/23144
60189645002	**29120 / LEADWOOD 002**	EPA 200.7	MPRP/31058	EPA 200.7	ICP/23144
60189645001	**29119 / LEADWOOD 001**	SM 2540D	WET/53566		
60189645002	**29120 / LEADWOOD 002**	SM 2540D	WET/53566		
60189645001	**29119 / LEADWOOD 001**	SM 2540F	WET/53499		
60189645002	**29120 / LEADWOOD 002**	SM 2540F	WET/53499		
60189645001	**29119 / LEADWOOD 001**	EPA 300.0	WETA/33200		
60189645002	**29120 / LEADWOOD 002**	EPA 300.0	WETA/33196		

Pace Analytical
www.pacelabs.com

Sample Condition Upon Receipt

WO# : 60189645

60189645

Client Name: Doe Run

Optional
Proj Due Date:
Proj Name:

Courier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Other ☐ Client ☐

Tracking #: 7791 0920 2610 Pace Shipping Label Used? Yes ☐ No ☐

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☒ Zip

Thermometer Used: T-239 / T-194 **Type of Ice:** Wet Blue None ☐ Samples received on ice, cooling process has begun.
(circle one)

Cooler Temperature: 5.5

Temperature should be above freezing to 6°C

Date and initials of person examining contents: JD 3/12

Chain of Custody present:	☒Yes ☐No ☐N/A	1.
Chain of Custody filled out:	☒Yes ☐No ☐N/A	2.
Chain of Custody relinquished:	☒Yes ☐No ☐N/A	3.
Sampler name & signature on COC:	☒Yes ☐No ☐N/A	4.
Samples arrived within holding time:	☒Yes ☐No ☐N/A	5.
Short Hold Time analyses (<72hr):	☒Yes ☐No ☐N/A	6. Sctt Solids
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	7.
Sufficient volume:	☒Yes ☐No ☐N/A	8.
Correct containers used:	☒Yes ☐No ☐N/A	
Pace containers used:	☒Yes ☐No ☐N/A	9.
Containers intact:	☒Yes ☐No ☐N/A	10.
Unpreserved 5035A soils frozen w/in 48hrs?	☐Yes ☐No ☒N/A	11.
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	12.
Sample labels match COC:	☒Yes ☐No ☐N/A	
Includes date/time/ID/analyses Matrix: WT		13.
All containers needing preservation have been checked.	☒Yes ☐No ☐N/A	
All containers needing preservation are found to be in compliance with EPA recommendation.	☒Yes ☐No ☐N/A	14.
Exceptions: VOA, Coliform, O&G, WI-DRO (water)	☐Yes ☒No	Initial when completed / Lot # of added preservative
Trip Blank present:	☐Yes ☐No ☒N/A	
Pace Trip Blank lot # (if purchased):		15.
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	16.
Project sampled in USDA Regulated Area:	☐Yes ☐No ☒N/A	17. List State:

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Jason Church 3/13/15

Project Manager Review: _____ Date: _____

THE **DOE RUN** COMPANY

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately

Page:	1	of	1

Section A Required Client Information:

Company:	The Doe Run Company
Address:	PO Box 500
Email To:	asanders@doerun.com
Phone:	(573) 689-4535
Fax:	(573) 244-8179
Requested Due Date/TAT:	5 To 7 Days

Section B Required Project Information:

Report To:	Amy Sanders
Copy To:	
Purchase Order No.:	
Project Name:	NPDES (Leadwood)
Project Number:	

Section C Invoice Information:

Attention:	Amy Sanders
Company Name:	The Doe Run Company
Address:	PO Box 500, Viburnum, MO 6556
Pace Quote Reference:	
Pace Project Manager:	
Pace Profile #:	

REGULATORY AGENCY

- NPDES
- GROUND WATER
- UST
- RCRA

Site Location STATE: MO

COC#: 1683

60189645

Requested Analysis Filtered (Y/N): N N N N N N N N N N N N N N N N N N

Section C Required Sample Information

Valid Matrix Codes

MATRIX	CODE
WATER	WT
WASTE WATER	WW
SOIL/SOLID	SL

*See Additional Comments Below

ITEM #	SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COMPOSITE START DATE (mm/dd/yy)	COMPOSITE START TIME (Military)	COMPOSITE END / GRAB DATE (mm/dd/yy)	COMPOSITE END / GRAB TIME (Military)	SAMPLE TEMP AT COLLECTION	Total # OF CONTAINERS	250 mL Unpreserved	500 mL Unpreserved	1 L Unpreserved	250 mL Nitric	250 mL Amber Glass H_2SO_4	250 mL Plastic H_2SO_4	1000 mL Amber HCL	250 mL ZnAc/NaOH	500 mL Amber Glass H_2SO_4	Analysis Test ↓	SEMO Lab Project No./ Lab I.D.	
~~1~~	~~29117~~	~~WT~~	~~G~~			~~03/12/15~~			~~2~~		~~1~~		~~1~~						~~CD-D, PB-D, ZN-D, HARD, SO4, CD-T, PB-T, TSS-T, ZN-T~~	~~Leadwood Downstream~~	aw
2																					
~~3~~	~~29118~~	~~WT~~	~~G~~			~~03/12/15~~			~~2~~		~~1~~		~~1~~						~~CD-D, PB-D, ZN-D, HARD, SO4, CD-T, PB-T, TSS-T, ZN-T~~	~~Leadwood Upstream~~	aw
4																					
5	29119 DPM BP24 BP3W	WT	G			03/12/15	1019	4/6	3	1		1	1						SO4, SS, TSS, CD-T, PB-T, ZN-T	Leadwood 001	a1
6	↓ ↓ ↓																				
7	29120	WT	G			03/12/15	1036	5.2	3	1		1	1						SO4, SS, TSS, CD-T, PB-T, ZN-T	Leadwood 002	a2
8																					
9																					
10																					
11																					
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ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME (Military)	ACCEPTED BY / AFFILIATION	DATE	TIME (Military)	Temp in °C	pH in SU	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)
	[signature]	3/12/15		[signature]	3/13	0835	5.5		Y	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:	Cory Woodruff
SIGNATURE of SAMPLER:	[signature]
DATE Signed (MM/DD/YY):	3/12/15

Monthly Ambient Air Monitoring Report

The Doe Run Company
Old Lead Belt Sites:
Federal, Rivermines, National, and Leadwood

February-2015

SUITE 300
1801 PARK 270 DRIVE
ST. LOUIS, MO 63146

Federal Site

Sample Results for **February-2015**

	St. Joe (Ballfields)		Big River#4		Water Treatment Plant	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
2/2/15	5	0.007	12	0.006	8	0.007
2/3/15	12	0.007	8	0.006	14	0.013
2/4/15	invalid	invalid	11	0.000	18	0.007
2/5/15	13	0.013	9	0.006	13	0.006
2/6/15	12	0.007	8	0.006	11	0.007
2/9/15	invalid	invalid	8	0.006	11	0.007
2/10/15	13	0.007	invalid	invalid	13	0.007
2/11/15	17	0.007	12	0.006	13	0.020
2/12/15	16	0.006	11	0.006	13	0.006
2/13/15	25	0.007	21	0.006	26	0.007
2/16/15	15	0.000	15	0.000	12	0.006
2/17/15	19	0.007	10	0.007	16	0.007
2/18/15	17	0.006	15	0.006	21	0.058
2/19/15	20	0.006	20	0.006	18	0.006
2/20/15	7	0.007	3	0.006	5	0.007
2/23/15	22	0.019	23	0.006	22	0.006
2/24/15	25	0.020	16	0.006	20	0.013
2/25/15	21	0.013	23	0.013	18	0.007
2/26/15	21	0.007	12	0.000	14	0.013
2/27/15	16	0.012	9	0.006	14	0.006

Monthly Avg. TSP	16	13	15
Monthly Avg. Pb	0.009	0.006	0.011
Jan-15	0.015	0.008	0.025
Dec-14	0.009	0.005	0.009
Rolling 3-Month	**0.011**	**0.006**	**0.015**

Three month rolling average must be less than 0.15 ug/m3

NOTES: St. Joe: 2/4, 2/9, <23hr run time
Big River #4: 2/10, <23hr run time

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
2/3/15	9	0.007
2/5/15	10	0.006
2/10/15	18	0.006
2/12/15	15	0.006
2/17/15	13	0.006
2/19/15	16	0.006
2/24/15	17	0.006
2/26/15		

Rivermines

Sample Results for **February-2015**

	Big River #4		Rivermines South #1		Rivermines North #2		Rivermines East #3	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
2/2/15	12	0.006	7	0.006	5	0.007	8	0.007
2/3/15	8	0.006	20	0.013	invalid	invalid	14	0.013
2/4/15	11	0.000	14	0.013	13	0.007	18	0.007
2/5/15	9	0.006	21	0.006	13	0.019	13	0.006
2/6/15	8	0.006	15	0.006	15	0.134	11	0.007
2/9/15	8	0.006	9	0.006	invalid	invalid	11	0.007
2/10/15	invalid	invalid	17	0.013	10	0.007	13	0.007
2/11/15	12	0.006	24	0.065	invalid	invalid	13	0.020
2/12/15	11	0.006	15	0.006	14	0.007	13	0.006
2/13/15	21	0.006	26	0.006	19	0.007	26	0.007
2/16/15	15	0.000	11	0.006	12	0.007	12	0.006
2/17/15	10	0.007	21	0.013	13	0.007	16	0.007
2/18/15	15	0.006	15	0.006	12	0.006	21	0.058
2/19/15	20	0.006	20	0.006	16	0.006	18	0.006
2/20/15	3	0.006	invalid	invalid	2	0.020	5	0.007
2/23/15	23	0.006	24	0.012	28	0.013	22	0.006
2/24/15	16	0.006	17	0.013	17	0.007	20	0.013
2/25/15	23	0.013	21	0.013	22	0.007	18	0.007
2/26/15	12	0.000	12	0.007	15	0.007	14	0.013
2/27/15	9	0.006	15	0.024	20	0.006	14	0.006

Monthly Avg. TSP	13	17	14	15
Monthly Avg. Pb	0.006	0.013	0.016	0.011
Jan-15	0.008	0.030	0.025	0.025
Dec-14	0.005	0.023	0.006	0.009
Rolling 3-Month	**0.006**	**0.022**	**0.016**	**0.015**

Three month rolling average must be less than 0.15 ug/m3

NOTES:

Big River #4: 2/10, <23hr run time
Rivermines South: 2/20, >25hr run time
Rivermines North #2: 2/3, <23hrs, timer set wrong by trainee,
2/9, <23hrs, bad bearing, 2/11, >25hr run time

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
2/3/15	9	0.007
2/5/15	10	0.006
2/10/15	18	0.006
2/12/15	15	0.006
2/17/15	13	0.006
2/19/15	16	0.006
2/24/15	17	0.006

National Site

Sample Results for **February-2015**

	Big River #4		Ozark #1		Soccer Park #2		Water Treatment Plant	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
2/2/15	12	0.006	13	0.006	10	0.013	8	0.007
2/3/15	8	0.006	14	0.007	12	0.013	14	0.013
2/4/15	11	0.000	11	0.006	invalid	invalid	18	0.007
2/5/15	9	0.006	invalid	invalid	25	0.038	13	0.006
2/6/15	8	0.006	14	0.007	19	0.020	11	0.007
2/9/15	8	0.006	8	0.000	13	0.007	11	0.007
2/10/15	invalid	invalid	21	0.007	22	0.026	13	0.007
2/11/15	12	0.006	22	0.007	14	0.007	13	0.020
2/12/15	11	0.006	16	0.006	16	0.007	13	0.006
2/13/15	21	0.006	27	0.007	27	0.013	26	0.007
2/16/15	15	0.000	17	0.006	16	0.000	12	0.006
2/17/15	10	0.007	20	0.007	20	0.013	16	0.007
2/18/15	15	0.006	30	0.006	27	0.026	21	0.058
2/19/15	20	0.006	21	0.006	26	0.025	18	0.006
2/20/15	3	0.006	6	0.000	8	0.007	5	0.007
2/23/15	23	0.006	22	0.006	29	0.038	22	0.006
2/24/15	16	0.006	31	0.020	30	0.033	20	0.013
2/25/15	23	0.013	29	0.007	33	0.040	18	0.007
2/26/15	12	0.000	20	0.007	23	0.007	14	0.013
2/27/15	9	0.006	14	0.006	17	0.019	14	0.006

Monthly Avg. TSP	13	19	20	15
Monthly Avg. Pb	0.006	0.006	0.019	0.011
Jan-15	0.008	0.009	0.016	0.025
Dec-14	0.005	0.005	0.008	0.009
Rolling 3-Month	**0.006**	**0.007**	**0.014**	**0.015**

Three month rolling average must be less than 0.15 ug/m3

NOTES: Big River #4: 2/10, <23hr run time
Ozark #1: 2/5, <23hr run time
Soccer Park #2: 2/4, <23hr run time

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
2/3/15	9	0.007
2/5/15	10	0.006
2/10/15	18	0.006
2/12/15	15	0.006
2/17/15	13	0.006
2/19/15	16	0.006
2/24/15	17	0.006

Leadwood

Sample Results for **February-2015**

	Big River #4		Leadwood South #1		Leadwood East #2		Leadwood North #3	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
2/2/15	12	0.006	7	0.007	8	0.007	12	0.007
2/3/15	8	0.006	10	0.006	11	0.006	11	0.007
2/4/15	11	0.000	13	0.007	12	0.000	12	0.000
2/5/15	9	0.006	13	0.006	12	0.006	9	0.000
2/6/15	8	0.006	16	0.006	12	0.000	9	0.000
2/9/15	8	0.006	15	0.013	10	0.007	8	0.000
2/10/15	invalid	invalid	13	0.006	16	0.013	11	0.007
2/11/15	12	0.006	18	0.013	7	0.000	8	0.000
2/12/15	11	0.006	32	0.026	8	0.007	9	0.000
2/13/15	21	0.006	33	0.006	22	0.006	22	0.007
2/16/15	15	0.000	12	0.006	10	0.000	8	0.000
2/17/15	10	0.007	18	0.006	13	0.006	15	0.000
2/18/15	15	0.006	20	0.019	18	0.006	16	0.006
2/19/15	20	0.006	20	0.025	19	0.006	14	0.006
2/20/15	3	0.006	10	0.006	0	0.000	4	0.000
2/23/15	23	0.006	26	0.032	29	0.013	21	0.007
2/24/15	16	0.006	14	0.019	17	0.006	14	0.007
2/25/15	23	0.013	21	0.026	30	0.013	20	0.007
2/26/15	12	0.000	21	0.032	3	0.000	14	0.000
2/27/15	9	0.006	18	0.018	17	0.012	13	0.006

Monthly Avg. TSP	13	18	14	13
Monthly Avg. Pb	0.006	0.014	0.006	0.003
Jan-15	0.008	0.011	0.006	0.005
Dec-14	0.005	0.007	0.005	0.004
Rolling 3-Month	**0.006**	**0.011**	**0.006**	**0.004**

Three month rolling average must be less than 0.15 ug/m3

NOTES: Big River #4: 2/10, <23hr run time

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
2/3/15	9	0.007
2/5/15	10	0.006
2/10/15	18	0.006
2/12/15	15	0.006
2/17/15	13	0.006
2/19/15	16	0.006
2/24/15	17	0.006

Federal Site

Sample Results for **February-2015**

Sample Date	St. Joe (Ballfields) **PM10** (ug/m3)	Big River#4 **PM10** (ug/m3)	Water Treatment **PM10** (ug/m3)
2/2/15	0	2	1
2/5/15	6	4	8
2/8/15	3	9	8
2/11/15	12	invalid	9
2/14/15	12	11	11
2/17/15	11	12	12
2/20/15	11	10	10
2/23/15	13	12	7
2/26/15	11	invalid	10

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	9	9	9

NOTES: Big River #4: 2/11, <23hr run time
Big River #4: 2/26, >25hr run time

Sample Date	Big River QA **PM10** (ug/m3)
2/5/15	3
2/11/15	11
2/17/15	13
2/23/15	18

Rivermines

Sample Results for **February-2015**

Sample Date	Big River #4 **PM10** (ug/m3)	Rivermines South #1 **PM10** (ug/m3)	Rivermines North #2 **PM10** (ug/m3)	Rivermines East #3 **PM10** (ug/m3)
2/2/15	2	5	2	1
2/5/15	4	6	10	8
2/8/15	9	13	10	8
2/11/15	invalid	invalid	9	9
2/14/15	11	14	10	11
2/17/15	12	invalid	10	12
2/20/15	10	16	12	10
2/23/15	12	9	2	7
2/26/15	invalid	10	8	10

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	9	10	8	9

NOTES:

Big River #4: 2/11, <23hr run time
Big River #4: 2/26, >25hr run time

Rivermines South #1:
2/11, <23hr run time
2/17, <23 hr run time, hour meter failed, new hour meter installed.

Sample Date	Big River QA **PM10** (ug/m3)
2/5/15	3
2/11/15	11
2/17/15	13
2/23/15	18

National Site

Sample Results for **February-2015**

Sample Date	Big River #4 **PM10** (ug/m3)	Ozark #1 **PM10** (ug/m3)	Soccer Park #2 **PM10** (ug/m3)	Water Treatment **PM10** (ug/m3)
2/2/15	2	1	2	1
2/5/15	4	1	8	8
2/8/15	9	8	8	8
2/11/15	invalid	14	14	9
2/14/15	11	12	11	11
2/17/15	12	16	15	12
2/20/15	10	10	11	10
2/23/15	12	11	15	7
2/26/15	invalid	9	55	10

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	9	9	16	9

NOTES: Big River #4: 2/11, <23hr run time
Big River #4: 2/26, >25hr run time

Sample Date	Big River QA **PM10** (ug/m3)
2/5/15	3
2/11/15	11
2/17/15	13
2/23/15	18

Leadwood

Sample Results for **February-2015**

Sample Date	Big River #4 **PM10** (ug/m3)	Leadwood South #1 **PM10** (ug/m3)	Leadwood East #2 **PM10** (ug/m3)	Leadwood North #3 **PM10** (ug/m3)
2/2/15	2	3	5	12
2/5/15	4	6	6	3
2/8/15	9	12	14	10
2/11/15	invalid	11	7	11
2/14/15	11	12	13	12
2/17/15	12	6	15	13
2/20/15	10	9	11	10
2/23/15	12	3	10	15
2/26/15	invalid	4	7	6

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	9	7	10	10

NOTES: Big River #4: 2/11, <23hr run time
Big River #4: 2/26, >25hr run time

Sample Date	Big River QA **PM10** (ug/m3)
2/5/15	3
2/11/15	11
2/17/15	13
2/23/15	18

Meterological Data - Old Lead Belt
February-2015

24hr average

Date	Wind Speed (MPH)	Wind Direction	Sigma-Theta	Temperature (C)	Air Pressure (mmHg)	Rain (Inches)	Power Supply (Volts)
01-Feb-15	6.0	248	22.30	3.5	740	0.48	13.67
02-Feb-15	5.8	297	24.19	-6.0	751	0	13.81
03-Feb-15	5.0	206	21.50	0.2	750	0	13.78
04-Feb-15	6.5	310	20.88	1.2	750	0	13.70
05-Feb-15	3.7	22	32.10	-7.2	757	0.02	13.87
06-Feb-15	5.3	203	18.86	2.3	750	0	13.74
07-Feb-15	7.6	196	17.70	9.3	742	0	13.57
08-Feb-15	6.8	254	18.13	13.3	739	0	13.47
09-Feb-15	8.0	352	17.06	2.3	748	0	13.65
10-Feb-15	2.9	79	34.99	-0.3	749	0	13.72
11-Feb-15	5.7	299	21.58	0.4	749	0	13.73
12-Feb-15	7.6	336	19.92	-5.4	755	0	13.79
13-Feb-15	4.7	201	19.98	-2.1	751	0	13.80
14-Feb-15	7.1	321	24.74	-1.4	750	0	13.76
15-Feb-15	5.5	70	24.58	-9.2	756	0	13.95
16-Feb-15	4.7	3	17.37	-8.5	749	0	13.91
17-Feb-15	3.2	244	22.84	-5.9	746	0.01	13.90
18-Feb-15	6.9	299	18.34	-9.7	750	0	13.85
19-Feb-15	3.5	253	27.17	-12.9	756	0	13.95
20-Feb-15	6.1	168	24.92	-6.5	749	0	13.91
21-Feb-15	2.0	321	12.02	0.4	745	0.42	13.81
22-Feb-15	8.0	352	17.61	-2.8	756	0.04	13.80
23-Feb-15	5.9	28	25.19	-10.0	761	0	13.93
24-Feb-15	4.4	230	20.72	-3.0	747	0.27	13.84
25-Feb-15	2.7	146	26.63	-1.4	743	0	13.84
26-Feb-15	7.6	335	18.78	-5.1	750	0	13.86
27-Feb-15	3.9	23	29.50	-10.1	760	0	13.95
28-Feb-15	3.5	102	25.05	-5.4	759	0	13.90

INQUEST
ENVIRONMENTAL INC.

3609 Mojave Ct., Ste E ◆ COLUMBIA, MO 65202
(573) 474-8110 ◆ FAX: (573) 474-8371

March 2, 2015

Mr. Greg Henson
Chemist
The Doe Run Company
881 Main Street
Herculaneum, Missouri 63048

RE: 1st Quarter 2015 Lead/PM10 Samplers and Meteorological System Performance Audit Report.

Dear Mr. Henson,

Please find enclosed the worksheets detailing the Lead/PM10 sampler's one-point flow verifications and meteorological sensors accuracy checks that were recently performed on the Doe Run Park Hills Monitoring Network. A copy of the current certifications for the audit devices that were used has also been enclosed.

All of the verifications and checks were found to be within expected guidelines.

After reviewing the enclosed information, please feel free to call with any comments or questions. Thank you for your business.

Sincerely,

John A. Kunkel
Inquest Environmental, Inc.

PM10 Sampler Verifications

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Leadwood (Mill St.)	Intercept (Qa)	-0.00876
Sampler	#2 PM10	Temperature	11.0 °C 284.2 °K
Flow Controller	P1018	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.057	23.80	44.45	0.942	1.127	**6.62**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.70	44.26	0.942	1.127	1.052	**-6.90**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Leadwood (School)	Intercept (Qa)	-0.00876
Sampler	#3 PM10	Temperature	11.0 °C 284.2 °K
Flow Controller	P6071	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.30	1.073	23.10	43.14	0.943	1.138	**6.06**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.139	1.070	**-5.31**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015		Auditor	John Kunkel	
Operator	The Doe Run Company		Transfer Orifice	1882	
Location	Park Hills Network		Slope (Qa)	1.04094	
Station	Leadwood (South)		Intercept (Qa)	-0.00876	
Sampler	#1 PM10		Temperature	11.0 °C	284.2 °K
Flow Controller	P1500		Station Pressure	30.03 "Hg	762.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.057	24.00	44.82	0.941	1.125	**6.43**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.80	44.45	0.942	1.126	1.054	**-6.73**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Big River	Intercept (Qa)	-0.00876
Sampler	#4 Primary PM10	Temperature	11.0 °C 284.2 °K
Flow Controller	P2952	Station Pressure	30.05 "Hg 763.3 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.057	23.90	44.64	0.942	1.113	**5.30**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.60	44.08	0.942	1.113	1.054	**-6.73**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Big River	Intercept (Qa)	-0.00876
Sampler	#4 QA PM10	Temperature	11.0 °C / 284.2 °K
Flow Controller	P1019	Station Pressure	30.05 "Hg / 763.3 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.30	1.073	24.40	45.57	0.940	1.124	**4.75**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.50	45.76	0.940	1.124	1.071	**-5.22**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Hanley Park/Crane St.	Intercept (Qa)	-0.00876
Sampler	#2 PM10	Temperature	10.0 °C 283.2 °K
Flow Controller	P2949	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.055	23.20	43.33	0.943	1.109	**5.12**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.10	43.14	0.943	1.109	1.052	**-6.90**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	St Joe Park	Intercept (Qa)	-0.00876
Sampler	#4 PM10	Temperature	10.0 °C / 283.2 °K
Flow Controller	P4353	Station Pressure	30.03 "Hg / 762.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.10	1.039	23.50	43.89	0.942	1.102	**6.06**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.60	44.08	0.942	1.102	1.035	**-8.41**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

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573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Rivermines (Wtr Plnt)	Intercept (Qa)	-0.00876
Sampler	#3 PM10	Temperature	10.0 °C 283.2 °K
Flow Controller	P2951	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.055	23.10	43.14	0.943	1.116	**5.78**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.30	43.52	0.943	1.116	1.051	**-6.99**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Rivermines (Quarry)	Intercept (Qa)	-0.00876
Sampler	#1 PM10	Temperature	10.0 °C 283.2 °K
Flow Controller	P4601	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.055	23.20	43.33	0.943	1.088	**3.13**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.20	43.33	0.943	1.088	1.054	**-6.73**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Rivermines (Above Quarry)	Intercept (Qa)	-0.00876
Sampler	#2 PM10	Temperature	10.0 °C 283.2 °K
Flow Controller	P4507	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.055	23.30	43.52	0.943	1.108	**5.02**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.40	43.70	0.943	1.108	1.052	**-6.90**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Ozark Insul. (National)	Intercept (Qa)	-0.00876
Sampler	#1 PM10	Temperature	10.0 °C 283.2 °K
Flow Controller	P2950	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.055	23.30	43.52	0.943	1.112	**5.40**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.20	43.33	0.943	1.112	1.052	**-6.90**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Lead/TSP Sampler Verifications

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Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
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573-474-8110

Date	January 20, 2015	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.04094		
Station	Big River Primary	Intercept (Qa)	-0.00876		
Sampler	#4 TSP	Temperature	10.0 °C	283.2	°K
Flow Controller	P4557	Station Pressure	30.03 "Hg	762.8	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.80	1.149	23.80	44.47	0.942	1.205	**4.87**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
24.10	45.03	0.941	1.204	**1.145**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Big River QA	Intercept (Qa)	-0.00876
Sampler	#4 TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P4558	Station Pressure	30.03 "Hg 762.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.80	1.149	23.50	43.91	0.942	1.201	**4.53**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.201	**1.147**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.04094		
Station	Leadwood Mill St.	Intercept (Qa)	-0.00876		
Sampler	#2 TSP	Temperature	11.0 °C	284.2	°K
Flow Controller	P4476	Station Pressure	30.04 "Hg	763.0	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.136	23.10	43.16	0.943	1.196	**5.28**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.10	43.16	0.943	1.196	**1.133**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Leadwood School	Intercept (Qa)	-0.00876
Sampler	#3 TSP	Temperature	11.0 °C 284.2 °K
Flow Controller	P6793	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.136	23.60	44.09	0.942	1.192	**4.93**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.50	43.91	0.942	1.192	**1.133**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Leadwood South	Intercept (Qa)	-0.00876
Sampler	#1 TSP	Temperature	11.0 °C 284.2 °K
Flow Controller	P4559	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.136	23.70	44.28	0.942	1.211	**6.60**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.70	44.28	0.942	1.211	**1.131**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	St Joe Park	Intercept (Qa)	-0.00876
Sampler	#4 TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P6792	Station Pressure	30.03 "Hg 762.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.134	23.20	43.35	0.943	1.198	**5.64**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.30	43.53	0.943	1.198	**1.130**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Hanley Park (National)	Intercept (Qa)	-0.00876
Sampler	#2 TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P4474	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.60	1.119	23.40	43.72	0.943	1.189	**6.26**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.187	**1.113**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Rivermines (Water Plant)	Intercept (Qa)	-0.00876
Sampler	TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P4475	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.134	23.20	43.35	0.943	1.195	**5.38**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.20	43.35	0.943	1.195	**1.131**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
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573-474-8110

Date	January 20, 2015	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.04094		
Station	Rivermines (Quarry)	Intercept (Qa)	-0.00876		
Sampler	#1 TSP	Temperature	10.0 °C	283.2	°K
Flow Controller	P2940	Station Pressure	30.04 "Hg	763.0	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.60	1.119	23.90	44.65	0.941	1.197	**6.97**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.90	44.65	0.941	1.197	**1.114**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
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573-474-8110

Date	January 20, 2015	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.04094		
Station	Rivermines (Above Quarry)	Intercept (Qa)	-0.00876		
Sampler	#2 TSP	Temperature	10.0 °C	283.2	°K
Flow Controller	P2941	Station Pressure	30.04 "Hg	763.0	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.134	23.70	44.28	0.942	1.200	**5.82**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.200	**1.130**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Ozark Insul (National)	Intercept (Qa)	-0.00876
Sampler	#1 TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P2939	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.80	1.149	23.00	42.97	0.944	1.201	**4.53**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.90	42.78	0.944	1.204	**1.150**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Calibration Orifice Certification Worksheet

TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVES, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Jan 13, 2015 Rootsmeter S/N 9833620 Ta (K) - 292
Operator Tisch Orifice I.D. - 1882 Pa (mm) - 765.81

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3360	4.3	1.50
2	NA	NA	1.00	1.0560	6.8	2.50
3	NA	NA	1.00	0.9570	8.2	3.00
4	NA	NA	1.00	0.8870	9.5	3.50
5	NA	NA	1.00	0.6670	16.5	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
1.0225	0.7654	1.2420		0.9943	0.7443	0.7563
1.0191	0.9651	1.6034		0.9910	0.9385	0.9763
1.0173	1.0630	1.7564		0.9892	1.0337	1.0695
1.0155	1.1449	1.8972		0.9875	1.1133	1.1552
1.0061	1.5084	2.4840		0.9784	1.4668	1.5125
Qstd slope (m) =		1.66236		Qa slope (m) =		1.04094
intercept (b) =		-0.01438		intercept (b) =		-0.00876
coefficient (r) =		0.99927		coefficient (r) =		0.99927
y axis = SQRT[H2O(Pa/760)(298/Ta)]				y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}
Qa = 1/m{[SQRT H2O(Ta/Pa)]- b}

Meteorological Sensor's Accuracy Checks

Inquest Environmental, Inc.
Wind Direction Sensor Performance Audit

Operator	The Doe Run Co	Date	01/15/2015
Location	Big River	Start Time	07:45
Station Name	Meteorological System	Stop Time	08:45
Technician	J Kunkel / M Kunkel		
		Station Declination	1.1 Deg
Sensor Mfg	RM Young	Measured Angle	180.0 Deg
Sensor Model	Wind Monitor AQ	Corrected Angle	181.1 Deg
Serial Number	128618	Alignment Error	-1.1 Deg
Sensor Height	10.0 Meters		

Vane Angle	Data Logger	Results	
		Difference	Total Error
Degrees	Degrees	± 3 Deg Limit	± 5 Deg Limit
0/360	0.9	0.9	-0.2
90	90.4	0.4	-0.7
180	180.5	0.5	-0.6
270	271.4	1.4	0.3

Average Difference (Degrees)	0.8
Average Total Error (Degrees)	-0.3

Audit Device	Wind Vane Alignment	Direction
Type	Pocket Transit	Vane Angle Fixture
Mfg.	Brunton	R.M. Young
Model	5008	18212
Serial No.	5080304492	None

Comments: Wind direction was verified by determining the orientation of the sensor in respect to True North. This was measured using a tri-pod mounted transit aligned along the length of the sensor while locked from rotating. A magnetic declination of 1.1 degrees was used to determine True North. The linearity of the sensor was determined by aligning the sensor to an indexed test fixture provided by the manufacturer. The four cardinal directions were verified using the fixture. No adjustments were made to the sensor.

Inquest Environmental, Inc.
Wind Speed Sensor Performance Audit

Operator: The Doe Run Co
Location: Big River
Station Name: Meteorological System
Auditor(s): J Kunkel / M Kunkel

Date: 01/15/2015
Start Time: 07:45
Stop Time: 08:45

Sensor Mfg: RM Young
Sensor Model: Wind Monitor AQ
Serial Number: 128618
Sensor Height: 10.0 Meters

Audit Standard		DAS Response		Limit
RPM	M/S	M/S	Difference	M/S
Zero	0.00	0.00	0.00	0.25
300	1.54	1.53	-0.01	0.25
600	3.07	3.07	0.00	0.25
1200	6.14	6.14	0.00	0.56
1800	9.22	9.22	0.00	0.71
3600	18.43	18.44	0.01	1.17
5400	27.65	27.63	-0.02	1.63
7200	36.86	36.85	-0.01	2.09
Average			0.00	

± (0.25 m/s + 5%)

Audit Device	Anemometer Drive
Type	Variable Speed
Mfg.	R.M. Young
Model	18801
Serial No.	CAO1631

Comments: Wind speed was verified using a variable speed anemometer drive. The propellor was removed from the sensor and the drive was connected using a flexible connector. The sensor was then rotated in the appropiate direction at several different speeds. Sensor responses were taken from the data logger. No adjustments were made to the sensor.

Inquest Environmental, Inc.
Temperature Sensor Performance Audit

Operator: The Doe Run Co
Location: Big River
Station Name: Meteorological System
Technician: J Kunkel / M Kunkel

Date: 01/15/2015
Start Time: 07:45
Stop Time: 08:45

Sensor Information

Sensor Mfg: Climatronics
Sensor Model: NA
Serial Number: NA
Sensor Height: 2 meters

Audit Device	Sensor	
°C	Data Logger °C	Difference °C
-0.8	-0.9	-0.1
29.1	29.0	-0.1
55.9	55.7	-0.2
	Average	-0.1

Note: The limit for each point is +/- 0.5 °C

Audit Device	
Type	Digital Thermometer
Mfg.	Control Company
Model	15-077-8
Serial No.	221381404

Comments: The temperature is verified by co-locating the sensor with a certified digital thermometer. The verification is conducted at three levels using two water baths (iced and hot water) and the ambient temperature. The sensor error was determined by comparing the sensor's data logger response to the display on the certified digital thermometer. No adjustments were made to the sensor.

Inquest Environmental, Inc.

Barometric Pressure Sensor Performance Audit

Operator: The Doe Run Co
Location: Big River
Station Name: Meteorological System
Technician: J Kunkel / M Kunkel

Date: 01/15/2015
Start Time: 07:45
Stop Time: 08:45

Sensor Mfg: Setra
Sensor Model: 276
Serial Number: 2626447

Audit Device	Data Logger Response	
mm HG	BP mm HG	Difference mm HG
747.10	750.40	3.30

Note: Limit is +/- 7.5 mm HG.

Audit Device	
Type	Digital Barometer
Mfg.	AIR
Model	AIR-HB-1A
Serial No.	6G3745

Comments: The barometric pressure is verified by co-locating the sensor with a certified digital barometer. The verification was conducted at one level after allowing the sensor and calibration device ample time to stabilize. The sensor error was determined by comparing the sensor's data logger response to the display on the certified digital barometer. No adjustments were made to the sensor.

Inquest Environmental, Inc.

Precipitation Gauge Performance Audit

Operator: The Doe Run Co
Location: Big River
Station Name: Meteorological System
Technician: J Kunkel / M Kunkel

Date: 01/15/2015
Start Time: 07:45
Stop Time: 08:45

Sensor Mfg: Texas Electronics
Sensor Model: TR525I
Serial Number: 36611-805
Diameter (inches): 6.00

Audit Device	Data Logger Response	
Known Tips	Gauge Tips	Difference %
96.00	93.00	-3.13

Note: Limit is +/- 10%.

Audit Device	
Type	Graduated Beaker
Mfg.	Texas Instruments
Model	FC-525
Serial No.	NA

Comments: The precipitation gauge output was verified using a field calibration kit supplied by the manufacturer. The kit consists of a graduated beaker and a calibration funnel using a precision orifice at the water outlet. Water was measured in the beaker and poured into the funnel while mounted on the gauge. The amount of precipitation recorded by the data logger was then compared to the known amount of water passing through the funnel. 100 tips equals one inch of rainfall. The gauge was cleaned and no adjustments were made.

Meteorological Audit Devices Certifications

BRUNTON OUTDOOR GROUP

CERTIFICATE OF CALIBRATION

Equipment Owner

Name: Inquest Environmental Mitch Kunkel

Address: 3609 Mojave Court, Ste E

Columbia MO 65202

Calibration traceable to the National institute of Standards and Technology in accordance with MIL-STD-45662A has been accomplish on the instrument listed below by comparison with standards maintained by the Brunton Outdoor Group. The accuracy and stability of all standards maintained by the Brunton Outdoor Group are traceable to national standards maintained by the National Institute of Standards and Technology in Washington, D.C. and Boulder, CO. Completed record of all work preformed is maintained by the Brunton Outdoor Group and is available for inspection upon request.

This unit has been calibrated to Lietz TM10E serial number 30937 traceable to N.B.S. Number 738227675 this July Day 30 20 14.

Description Pocket Transit

Purchase Order 256430329

Order Number SO-070367

Model Number F-5008

Serial Number 5080304492

Calibration Date 7/30/14

Recalibration Date 7/30/15

Signed [signature] 7/30/14

Quality Control Coordinator

CERTIFICATE OF CALIBRATION AND TESTING

MODEL: **18801** (Comprised of Models 18820 Control Unit & 18830 Motor Assembly)
SERIAL NUMBER: CA01631

R. M. Young Company certifies that the above equipment was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating the measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

Nominal Motor Rpm	Output Frequency Hz (1)	Calculated Rpm (2)	Indicated Rpm (3)
600	320	600	600
1200	640	1200	1200
2400	1280	2400	2400
4200	2240	4200	4200
6,000	3200	6000	6000
8,100	4320	8100	8100
9,900	5280	9900	9900
☒ Clockwise and Counterclockwise rotation verified			

(1) Measured at the optical encoder output.
(2) Frequency output produces 32 pulses per revolution of motor shaft.
(3) Indicated on the Control Unit LCD display.

* Indicates out of tolerance

☒ No Calibration Adjustments Required ☐ As Found ☐ As Left

Traceable frequency meter used in calibration Model: DP5740 SN: 4863

Date of inspection 10 Dec. 2014
Inspection Interval One Year

Tested By EC

ACCREDITED
Calibration
Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4000-5872220

Traceable® Certificate of Calibration for Digital Thermometer

Cust ID:Inquest Environmental Inc., 3609 Mojave Ct. Suite E, Attn. Mitchell Kunkel, Columbia, MO 65202 U.S.A. (RMA:986002)

Instrument Identification:

Model Numbers: 15-077-8, FB50266, 245BY S/N: 221381404 Manufacturer: Control Company

Model: 15-077-7 S/N: 51202300

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/24/15	1000351744
Temperature Probe	128	3/12/15	15-CJ73J-4-1
Temperature Calibration Bath TC-218	A73332		
Thermistor Module	A27129	10/25/14	1000346002
Temperature Probe	5202	11/30/14	15-B15PW-1-1
Temperature Calibration Bath TC-256	B01375		
Thermistor Module	A27129	10/25/14	1000346002
Temperature Probe	5267	10/19/15	15-CD5J7-1-1

Certificate Information:

Technician: 68 Procedure: CAL-06 Cal Date: 4/14/14 **Cal Due: 4/14/15**

Test Conditions: 22.5°C 50.0 %RH 1007 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C	0.000	0.106	N	0.000	-0.001	Y	-0.050	0.050	0.013	3.8:1
°C	25.001	25.097	N	25.001	24.999	Y	24.951	25.051	0.023	2.2:1
°C	60.000	60.103	N	60.000	60.000	Y	59.950	60.050	0.014	3.6:1
°C	100.004	100.082	N	100.004	99.997	Y	99.954	100.054	0.018	2.8:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Digital Thermometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Thermometers change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

HASS INSTRUMENT CORPORATION
6711 OLD BRANCH AVENUE • CAMP SPRINGS, MD 20748-6990 • (301) 449-5454 • FAX (301) 449-5455

CALIBRATION REPORT

BAROMETER/ALTIMETER
AIR Model AIR-HB-1A
Serial No. 6G3745

TEST POINT	TEST PRESSURE	DIGITAL READOUT	READOUT ERROR	CORRECTION REQUIRED
1	930.00	931.9	+1.9	-1.9
2	970.00	971.9	+1.9	-1.9
3	1010.00	1012.0	+2.0	-2.0
4	1050.00	1051.9	+1.9	-1.9
5	1018.01	1019.9	+1.9	-1.9

NOTES:

1. All data are in Millibars (hPA) and were taken at 75 F (24 C).
2. To correct the Digital Readout of the instrument, either algebraically add the CORRECTION REQUIRED to, or algebraically subtract the READOUT ERROR from, the readout shown on the instrument.
3. The TEST PRESSURE was generated using Type A-1 Barometer S/N 3327, and was approached in an increasing-pressure direction.
4. The TEST PRESSURE for TEST POINT 5 was ambient atmospheric pressure.
5. The BAROMETER/ALTIMETER was horizontal during the calibration.
6. The LCD screen of the BAROMETER/ALTIMETER has some trash in the center of the display, but it does not interfer with the readout.
7. Although the Digital Readout of the instrument can be adjusted to incorporate the average CORRECTION REQUIRED, this has not been done.

Calibration Date: 5 February 2014

By: Bernard I. Hass
Bernard I. Hass

(SEAL)